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August 4, 1988

Memorandum to: Members of the Governor's Cable/ Geothermal Advisory Board

From: William F. Quinn, Chairman

The attached is an excellent report made by a group headed by Mayor Carpenter and including Dr. Matsuda which visited various California geothermal projects. The group talked to many government and development people and covered many ideas which are certainly relevant to the questions which should be addressed by our Board.

I anticipate calling a Board meeting shortly to go over matters contained in this report as well as the subjects which I discussed with the Governor.

W. F. Quinn

WFQ:vbw
Attachment

Geothermal Mission to California

A Report to the Governor's Advisory Board
On the Underwater Cable Transmission Project

July 29, 1988

Table of Contents

Geothermal Mission to California

A Report to the Governor's Advisory Board On the Underwater Cable Transmission Project

This is a report to the Governor's Advisory Board on the Underwater Cable Transmission Project summarizing the results of a series of meetings with business and government leaders involved in geothermal energy development in California and Nevada.

A major purpose of the trip to California was to talk to business and government officials involved in the development of geothermal energy and to acquaint them with the potential for developing geothermal energy in Hawaii. We also went to learn how geothermal development is managed by various government agencies, utilities and developers in California with the aim of using this information to help us develop our own master plan for development in Hawaii.

As we did on our geothermal mission to Japan last November, we kept our message brief and to the point: We are serious about developing our geothermal resource, and we are seeking potential developers and financing to help us develop that resource.

As in Japan, the response in California was enthusiastic and heartening. However, several problem areas were pointed out to us — problem areas that we hope will be addressed during the 1989 session of the State Legislature.

Executive Summary

The following is a summary of valuable information we learned on the trip:

1. Interest by major American developers. American geothermal developers in California are interested in participating in an international consortium to develop geothermal energy in Hawaii.

Bechtel, an engineering firm and construction company, did the initial plans for the Thermal Power power plants in Puna more than 10 years ago. Like the cable and power plant manufacturers in Japan, Bechtel is interested in organizing a consortium, master planning and financing. It believes this work should begin immediately if development is to take place.

Unocal, the largest geothermal developer in the world, has developed more than 600 megawatts of power in the Philippines in just a few years. It also developed more than 1,100 megawatts in the Geysers and Imperial Valley.

Under the proper conditions, we believe Bechtel and Unocal have the capacity to undertake a major international development.

2. Ormat's 12.5 megawatt plant to be on line by 1989. Ormat Energy Systems appears to be strongly motivated, technically competent and well-financed. The Ormat development appears to be the crucial first step in the overall plan. The first Ormat power plants must be successful and on line by the end of next year in order to encourage future development by major international developers like Bechtel or Unocal.

3. Hawaii must develop technical expertise in geothermal permitting. The state must begin to develop technical expertise to handle the development, legal and regulatory aspects of geothermal permitting. The California Energy Commission handles all regulation and permitting for major California power plants. It has a staff of 420 and a yearly budget of $60 million. Training Hawaii personnel in California and bringing experts and consultants in from California may be a good start in developing our own technical expertise.

4. Formation of state energy commission. Coordinated federal, state and county support is crucial for well-organized, well-financed and well-planned development. To accomplish this end, the state may want to consider organizing an energy commission to formulate the initial requirements for a 500 megawatt development, to begin master planning to coordinate future development with Hawaiian Electric and government agencies, to oversee existing development and to approach potential consortium participants.

5. Staffing for energy commission. The California Energy Commission is a good model. It appears to be efficient, competent and perceptive. There are five full-time members on the commission. They have processed more than 19 geothermal power plant applications since their formation.

Because of a reduced initial workload, three members may be all we need in Hawaii. Similarly, an initial staff of six or seven people may be sufficient for our needs. They could be experts in (1) planning for steam fields and energy forecasts; (2) siting, air,

water, noise, flora and fauna and native Hawaiian concerns; (3) new technology and research; (4) engineering; (5) legal services; and (6) administration.

6. Information meetings for political, business, labor and community leaders. Information meetings should be scheduled to keep our congressional delegation, state executive branch, state legislators, county executive branch, county council members, Hawaiian Electric, the University of Hawaii, landowners, developers, interested members of the construction industry, labor officials and community leaders up to date on the progress in geothermal development and in the development of a state energy commission.

7. Subcommittee should begin work immediately. The governor could be asked to organize a subcommittee of the cable board or a new task force immediately to begin planning for the state energy commission. As part of this planning, the subcommittee or task force could begin coordinating master planning with various governmental agencies and Hawaiian Electric, legislative drafting, planning for staff training and helping the Department of Land and Natural Resources in environmental permitting.

In order not to lose our momentum or delay the Ormat plants, the first of which should be on line by 1989, Hawaii will need legislation introduced in the 1989 session to create the commission. State law on geothermal leases, mineral rights and mineral extraction should be reviewed and refined.

The legal relationship between the energy commission and other state agencies such as the Public Utilities Commission, State Board of Land and Natural Resources and Department of Health must be carefully examined and discussed before drafting legislation.

The organization of the consortium and whether Hawaiian Electric will merely purchase power or be involved in power plant ownership and operation must be carefully considered. Whether the state or Hawaiian Electric takes an equity position in the consortium should also should be considered.

The first chairman and members of the energy commission should be carefully considered, for the initial composition of the commission will be crucial to its success.

Background

The trip to California lasted from May 18 to May 28. The trip had several purposes. The purpose of the geothermal portion of the trip was three–fold: To promote interest in geothermal development in Hawaii; to learn how geothermal development has been managed by government agencies, utilities and developers in California; and to use the information to help us in our own master plan for development in Hawaii.

The following people participated in the geothermal portion of the mission:

Mayor Dante K. Carpenter—he represented the County of Hawaii and the Governor's Advisory Board on the Underwater Cable Transmission Project.

Dr. Fujio Matsuda, president of the Research Corporation of the University of Hawaii—he represented the Governor's Advisory Board on the Underwater Cable Transmission Project.

William Bonnet, project manager for the deep water cable program—he represented Hawaiian Electric Co., Inc.

Harold Tanouye, chairman of the Mayor's Geothermal Energy Advisory Commission—he represented the mayor's commission.

Lawrence D. Kumabe, a deputy attorney general and member of the Mayor's Geothermal Energy Advisory Commission—he served as a legal resource person and represented the mayor's commission.

The itinerary for the geothermal portion of the trip was coordinated by Phyliss Minn of U.S. Senator Daniel K. Inouye's office in Washington. Dominic Falcone handled our California itinerary and acted as our guide and consultant.

Our meetings took place in San Francisco, Santa Rosa and Sacramento in California and in Reno, Nevada, which is near the Geysers geothermal fields in northern California. The Geysers is the leading geothermal field in the world, producing more than 1,900 megawatts of power a year—about 10 percent of the power distributed by Pacific Gas and Electric (PG&E) to its northern California power grid.

Mission Highlights

The following is a brief description of the highlights of the mission:

Unocal

Falcone drove us to Santa Rosa to meet with the Unocal Geothermal Division. Unocal's operations cover 21,200 acres. They have drilled 355 wells that generate more than 1,100 megawatts of power. The power is sold to PG&E. Unocal is by far the largest geothermal developer in the world. In the past 10 years, it has developed geothermal fields in the Philippines that now produce more than 600 megawatts of power.

We met with Joel P. Robinson, Unocal's Santa Rosa district manager for operations; Michael L. Shoaff, Santa Rosa district manager for land; and Richard Dondanville, regional manager for exploration.

Unocal seems pleased with its working relationship with state agencies in California, particularly the California Energy Commission. The permitting process is predictable. Unlike Hawaii, specific time limits were established to complete various permits. For example, use permits must be completed within 165 days from the date of application; air permits, within 345 days; and water permits, within 345 days. In addition, the State Public Utilities Commission issues certificates of public necessity to ensure that the power can be purchased by the public utility involved and sets rates for the purchase of that power. The California Energy Commission coordinates all state and county agency permits.

In 1979, Unocal examined the Puna fields, Hawaii's structure of land ownership, mineral rights and leasing and the market for geothermal power. At that time, a market for geothermal power did not exist. Now, because the deep–water cable to transmit power from the Big Island to Honolulu is proving feasible, a sizeable market may exist. More than 500 megawatts of electrical power can be generated on the Big Island and sold in Honolulu.

Therefore, Unocal is now primarily interested in land ownership and mineral rights in Hawaii. The ownership of mineral rights has not been settled in Hawaii. Our courts have not yet decided whether geothermal energy is a mineral right, whether private landowners may still own mineral rights or whether all mineral rights are owned by the state. The issue of ownership is important so developers like Unocal know the cost of royalties to be paid to the state, county or private parties. A court action between the state and counties to clarify the question may be a appropriate way to handle this point.

Second, in California, as in Texas and Oklahoma, the mineral or subsurface estate is the dominant estate. This means that a mineral owner, like Unocal, may enter a property to mine minerals or geothermal steam merely by paying the surface owner damages for its access to the drilling site and for its occupation of the surface with its drilling rigs. However, Unocal generally negotiates royalties with the surface owner rather than seizing and occupying the surface. In Hawaii, this issue would require further study and possibly legislation.

Third, Unocal also wanted to know whether geothermal leases on the extensive state lands in the Puna geothermal fields can be obtained through competitive sealed bids or

by negotiations with the state instead of public auction, as is the case now. This issue would also have to be studied further.

Unocal also asked us about the Puna geothermal resources. Much more will be known about the commercial potential of the Puna steam fields after the experimental "slim hole" wells are completed and the first commercial wells are placed in operation by Ormat.

Sonoma County

Most of the Geysers steam fields are located in Sonoma and Lake counties. Sonoma County has a population of about 360,000 and an area of about 1,600 square miles. James Gallagher, Sonoma County tax assessor, advised us that about 1 to 2 percent—$3 million to $4 million—of the county's revenue comes from property taxes assessed against the Geysers steam field developers. The fields are assessed according to the present value of the income stream generated from the fields ("income method" of assessment). California receives royalties of about 10 percent of the gross income. These state royalties are paid into the teachers' retirement fund.

A geothermal energy coordinator, Steven J. Sharp, helps Sonoma County coordinate permits. His income is paid for by use permits issued to the developers. There are three basic levels of permitting. Permits for exploration and preliminary drilling are handled by the State Division of Oil and Gas. Permits for steam field development and drilling are handled by the counties. Permits for power plants larger than 50 megawatts are handled by the California Energy Commission. Permits for smaller plants are handled by the county.

As air quality specialist, Sean Connoly, is paid by the state to help the county in air pollution control and environmental permitting. There have been almost no environmental complaints with air or water pollution since the development began. There used to be a few noise and odor complaints, but with recent technology, these problems have been solved. The major county problem now is locating the sites for the disposal of geothermal wastes, a problem that we share in Hawaii.

Another problem we share is the condemnation of corridors for transmission lines. Sonoma County went to court recently to oppose power corridors condemned by the state and Pacific Gas and Electric. The county felt it gained a favorable result, since a settlement with developers provided new paved roads throughout the Geysers.

Pacific Gas & Electric

We met with Richard Jones, of the company law department; David Bergmann, geothermal projects coordinator; Charles Hicklin, senior mechanical engineer for the design and construction of geothermal power plants; L. Dean Cooley, head of geothermal power plant operations; Robert L. Eddy, power plant siting and licensing engineer; Raymond Camacho, senior electrical engineer for power contracts; and Samuel L. Altshuler, supervising mechanical engineer for environmental abatement systems.

We first asked for their thoughts on the development of geothermal energy instead of new coal–fired plants. PG&E advised us that in California, hydroelectric power is considered the least expensive method of generating electricity. Geothermal energy is second. Nuclear energy has extremely low operating costs, but the cost of the initial capital investment is extremely high. Fossil fuel generation plants, such as oil–fire plants, are

relatively expensive to operates and are far more undesirable environmentally than geothermal.

PG&E has found that geothermal energy is reliable and also environmentally clean. In addition to more than 2,000 megawatts in the Geysers fields, 1,000 megawatts has been developed in the Imperial Valley. California hopes to develop more than 1,000 megawatts of additional power from the steam fields in the Imperial Valley and Indio. In summary, California favors developing geothermal energy over fossil fuels.

Second, geothermal energy is a renewable resource. However, it must still be managed properly. Individual wells appear to have a useful life of about 30 years. New technology such as building dikes or ponds, or reinjecting geothermal fluids to renew the steam fields, is being developed in the Geysers now.

Puna, may not have California's problems in this area. But PG&E advised us that master planning could be more effective if Hawaii would determine the nature and extent of the Puna fields. The slim hole drilling will be helpful. PG&E also suggested that a geothermal steam field consultant, such as the Stanford Resource consultants, should be retained to determine the nature and magnitude of Hawaii's fields.

Third, we discussed the steam field contracts with the steam field developers. PG&E has been able to negotiate very favorable steam field contracts with Unocal. For example, under these contracts, not only is the price of steam fixed by a formula based on power generation, but Unocal is prohibited from selling steam to any other party, even if it could get a better price. This contract is currently being litigated by Unocal.

Finally, we discussed the issue of whether the steam field developer or public utility should construct and own the power plants and transmission lines. Right now, Unocal explores and drills in the Geysers steam fields, then supplies steam to PG&E. PG&E builds and operates the power plants, owns the transmission corridors and constructs the power lines to transmit power to its power grid.

However, it may be more economical for the developer rather than the utility to build and operate power plants and transmission lines. Profits could then be spread over all of these areas so overall operation is more economical. The Imperial Water district and southern California Edison, unlike PG&E, are currently purchasing power from developer–operated power plants in the Imperial Valley. We may want to examine this arrangement in Hawaii.

Bechtel National, Inc.

We met with Jon Pietruskiewicz, manager of business planning and development, Division of Research and Development; Clay B. Claasen, Jr., construction manager; and Janet Owen, business development representative. This was also an extremely helpful meeting.

We learned that Bechtel designed the first 25 megawatt power plants in the Puna fields for Thermal Power more than 10 years ago. Because of the change in ownership from Natomas to Diamond Shamrock, then to Maxxus and now to Ormat, Bechtel has not recovered its costs. The project has been extremely slow getting started. With the development of the 500 megawatt cable, however, the company is still very interested.

Like the Japanese corporations we visited last November, Bechtel officials advised us to organize as quickly as possible a consortium for the development of 500 megawatts of power in the Puna fields. This consortium could include a construction company like Bechtel, a steam field developer, a cable manufacturer, the public utility, the state and financial institutions. Bechtel could help in financing, constructing power plants and transmission lines, legislation and lobbying. Bechtel has built a number of geothermal power plants and transmission lines in the Geysers and elsewhere.

Bechtel can also design the master plan as part of its capital contribution. However, there must be initial cash flow from the first projects in order to attract and maintain the interest of an organization like Bechtel. The success of the initial projects is the basis for master planning the larger project.

As a result, we were convinced that organization of the consortium and master planning for the Puna project must begin as soon as possible. In order to do this, the state must begin immediately to formulate an energy commission, or its equivalent, to help organize, regulate, formulate and evaluate appropriate requests for proposals.

Ormat Energy Systems, Inc.

We met with Ormat officials at the company offices in the Embarcadero Center. They were Hezy Ram, president; Daniel Schochet, vice president; and Maurice Richard, marketing manager.

Our timing was excellent. Ormat advised us that it had purchased thermal Power from Maxxus a few days before our meeting. Officials said they want to develop the Puna fields in Hawaii. There were in the process of raising the capital necessary for the project and obtaining the permits to complete drilling. They felt confident that they could bring the first 12.5 megawatts on line by 1989 and the full 25 megawatts by 1992—assuming the permitting process goes smoothly.

Ormat was founded in Israel in 1965 by Lucien Bronicki, it current president. Its purpose was to use research from the National Physical Laboratory in Jerusalem to develop and market highly reliable on–site power generators. Ormat generators are used by Lear–Siegler in the construction of Israeli–built aircraft and on the Alaska pipeline, where Ormat generators, with very low maintenance, supply power for pumps and other equipment.

During the 1974 energy crisis, Ormat developed new generators using this technology for use with alternative energy sources. In 1986, Ormat Energy was formed in a joint venture with LFC Financial of Philadelphia to actively seek out and develop alternative energy projects.

Ormat is now building a 30 megawatt power plant in the Imperial Valley, Ormesa I, and another 20 megawatt plant nearby, Ormesa II. The power is being sold to Southern California Edison. Ormat raised $88 million through Bankers Trust Co. of New York and Sumitomo Bank for Ormesa I and $66 million through Bankers Trust and Bank of Nova Scotia for Ormesa II. Ormesa I is owned jointly with LFC and Ormesa II with Baltimore Gas & Electric and Bell Atlantic. Ormat also has smaller power plants in Soda Lake, Steamboat, Empire and Wabuska, Nevada, and at Sulphurdale, Utah.

Ormat's plants are based on 1 megawatt modular units. Using hot water from the geothermal fields, the unit uses a heat exchanger to turn an organic fluid into gas for the turbines. Because Ormat requires only hot water, a relatively low-temperature resource, it

does not have to drill as deep as some other steam field developers. Moreover, its modular units can be brought in by truck and installed in place with minimal construction costs. Once in place, the units require little maintenance.

For example, we visited the company's 10 megawatt plant in Steamboat, Nevada. Only three employees are required, one for each of the three eight-hour shifts. The company is considering cutting back to two employees. One of the modules can be serviced without shutting down the other modules and interrupting the flow of power. The modules are easily disassembled and moved by truck in an emergency such as a lava flow. The plant was set back from the highway and placed behind an earth barrier so it could not be seen or heard. As at the Geysers plants, there was no sulfide odor.

Geysers Tour

Thanks to Unocal, we toured the Geysers geothermal fields. Kevin Talkington, a landman with the Santa Rosa District, was our guide. The steam fields stretched more than 20 square miles in the mountains above Santa Rosa. The roads were private and well-paved. There were security guards at the gates to the development to control ingress and egress. As Dr. Matsuda remarked, "The air smells good here." We were impressed with the lack of odor or trace of hydrogen sulfide and with the order and cleanliness of the development.

The Unocal-PG&E, Sacramento Municipal Utility District, Central California Utility District and Northern California Utility District projects were examples of extremely successful projects. However, even in the Geysers there were some failures. The GRI project was unsuccessful, generating only half the steam they were designed to generate. They produce only half the 111 megawatts of power that was originally anticipated.

Also, the state's power plant was sitting there useless, a white elephant. It was constructed where there was no steam at all. The State of California's adventure into geothermal development is perhaps a less for us all in Hawaii.

After its experience in the Geysers, Unocal is developing the power plants and transmission lines as well as the steam fields in Southern California. Dr. Carel Ottee, president of Unocal Geothermal, was the initial pioneer who more than 30 years ago foresaw the profitability of the Geysers fields for geothermal development.

Munson Geothermal, Inc.

The following day we met with Stephen Munson, president of Munson Geothermal, Inc., in Reno, Nevada. Munson is an entrepreneur who raised the capital necessary to fund Munson Geothermal. We visited his Brady Geothermal Park, where he has contracts with and expects to generate sufficient electricity to sell 20 megawatts of power to the Sierra Pacific Power company. Munson also owns the Raft River geothermal plant and has sizeable geothermal leases.

In addition to his interest in developing geothermal energy, Munson is interested in developing aquaculture in Hawaii. We met Jon Lindbergh, the son of the famous aviator and an associate of Munson's, who is one of the leading experts in aquaculture. Lindbergh flew over from North Bend, Washington, to meet us in Reno. The two are interested in obtaining land in Puna for an aquaculture project using catfish, bass or shrimp.

University of California at Davis

The next morning we met with Dr. Charles Goldman, head of the aquaculture research facility at the University of California at Davis. He is working with Dr. Serge Doroshov. Dr. Doroshov, originally from the soviet Union, is the world's leading expert on sturgeon. He grows sturgeon in pens under controlled conditions. They attain a good size rapidly and are very efficient converters of feed into food. Both the meat and caviar of the sturgeon are valuable.

The two researchers believe the Puna geothermal fields can provide clean, warm water for sturgeon production in Hawaii. The waters near Sacramento are now relatively polluted from pesticides and herbicides. Aquaculture farms are just beginning in California. Experts like Dr. Doroshov could form the nucleus of a world-renowned aquaculture facility at the University of Hawaii and serve as the base for the development of commercial aquaculture in Hawaii.

Land Department, State of California

We met with Ron Small, an attorney with the Land Department in Sacramento. He first described the process of negotiating royalties for geothermal leases in California. The California Land Board is comprised of the director of finance, who is appointed by the governor; the lieutenant governor, who is elected; and the comptroller, who is also elected. The board requests sealed bids for geothermal leases. In California, geothermal resources are considered mineral leases, and the state owns all mineral rights.

The lease usually involves a flat rate and a percentage of net profit. The flat rate is usually from 10 to 12 and one-half percent of gross sales. The percentage of net profit ranges from 22 to 47 percent. At one time, about $10 million in revenue was generated in royalties for the state. The funds are earmarked for the California Teachers Retirement System.

Although sealed bids are normally required, Small saw a great deal of value in negotiated leases. California law allows the negotiation of leases. Sometimes, the high bidder may not have the resources or ability to carry a project through. If the project fails, the state loses revenue. Requests for proposals could be made to selected developers. After the requests are made, negotiations with able, reputable and well-capitalized developers may begin.

There have been relatively few problems with surface owners. They generally have been able to negotiate favorable royalty agreements with the developers.

California Energy Commission

We met with Barbara Crowley, vice chairwoman of the commission; Bob Therkelson, chief of the Siting and Environmental Division; and Norman Wilson, one of the managers. Karen Edson, an energy consultant and former commissioner, accompanied us.

We were immediately impressed with the magnitude of the commission. It has handled permitting for 12 geothermal power plants, all larger than 50 megawatts. These projects involve more than 1,200 megawatts of power. The commission has a budget of more than $60 million a year, funded by a one-tenth mill surcharge on utility rates. It has more than 420 employees and its own building in Sacramento.

California's Public Utilities Commission actually determines if the power produced can be sold and distributed to consumers—ie., if there is sufficient need. It also determines the rates. However, only the California Energy Commission has the staffing and expertise to evaluate the siting and construction of the powers plants, their engineering, efficiency and environmental impact.

The commission has five members, and executive director and five major divisions—Conservation; Development, including new technology and research and development; Forecasting and Planning, including 12-year energy forecasts; Siting, including engineering, environment and siting; and administrative services.

The State of California favors geothermal development as a matter of policy. Therefore, there is an expedited permitting process for geothermal- as opposed to oil- and gas- produced energy. The commission reviews the need for the power plants, environmental impact, public health and safety, reliability and efficiency. Each permit is reviewed by a subcommittee of two commissioners. The public advisers and staff work with intervenors, giving them notices of all meetings and public hearings. Special meetings, called public workshops, are held between staff and intervenors or other interested parties on various issues raised in the environmental impact statements and other documents to explain the technical solutions to the problems. Specific timelines are established.

The commission's technical staff have become experts in hydrogen sulfide, waste disposal, noise abatement, lighting, flora and fauna and even in Indian affairs. As a result, the public's questions are addressed and developers' permits are evaluated with considerable expertise and efficiency. All the parties we spoke with had a great deal of respect for the commission.

It was suggested that with the proper legislation or contracts, some of these experts could be lent to us as we develop the state's technical capacity to handle geothermal development here. It was also suggested that an employee exchange might be possible to train our technical personnel in California.

Recommendations

Based on the results of our mission, we make the following recommendations:

1. Formation of Subcommittee. A task force or subcommittee of the Governor's Advisory Board on the Underwater Cable Transmission Project should be organized quickly to examine the formation of a Hawaii Energy Commission and other issues crucial to orderly geothermal development. The subcommittee should be funded and staffed, and it should be responsible for implementing the fast-track permitting established now to expedite the Ormat permits.

2. Energy Commission. Legislation should be prepared for a Hawaii Energy Commission to oversee the development and permitting process. The California Energy Commission is an excellent model. Its organization, responsibilities and structure should be established. Various sources of funding should be examined. Experts from the California commission could be retained and staff trained to gain technical expertise in evaluating permits. The relationship between the energy commission and Public Utilities Commission and other regulatory agencies should be carefully examined at the outset.

3. Land and Mineral Ownership. Legal issues such as the ownership of the state's mineral resources and royalties must be examined immediately. Legal action should be started or laws drafted to address concerns about the ownership of mineral rights and rights of the subsurface owner in relationship to the surface owner. The state's system of auctioning geothermal leases on state land and sealed bid procedure should be re-examined.

4. Master Plan for Development. Meetings should be organized immediately with interested federal, state, county and legislative leaders in Hawaii and with Hawaiian Electric to develop a master plan for development and to discuss the potential participants for a development consortium. Hawaiian Electric's input is crucial. Requests for proposals should be formulated, if necessary, for potential participants. Experts should be retained to determine the extent of the fields through slim hole research and steam field development and to help in the master planning.

5. Related Direct Uses. At the same time, related direct uses for geothermal energy, such as aquaculture or nursery use, should be examined. Potential developers should be encouraged. Meetings with the University of Hawaii should be held to develop a technically trained staff for geothermal development, aquaculture and other needed disciplines.

6. County Involvement. Hawaii County's need for revenue and the cost of the infrastructure and transmission corridors is another issue that should be addressed immediately.

7. Energy Commissioners. The selection of the initial energy commissioners or their equivalent should be carefully considered. It would be helpful if potential commissioners could be considered and selected by the end of the 1989 legislative session so they could help in the Ormat development and begin planning for the consortium.